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Mental Imagery and Basketball: A Comparison of Cognitive-specific and Flow Imagery

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Positive psychology is a relatively new and vibrant subdiscipline that has generated considerable interest and research. It is concerned with how people derive happiness and enjoyment through their involvement with and interpretation of their environment. One area within positive psychology that has been especially interesting is the study of optimal experience and performance, or flow. Flow describes an optimal psychological state that presents itself in conjunction with optimal performance. Research has found that flow experiences are likely to occur when an individual perceives a challenge in their environment to match their ability to act. One environment that is conducive to flow experience is sport

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Abstract

Flow is a psychological state that is associated with optimal performance. Sports such as basketball are conducive to an individual experiencing flow because they have rules that structure and focus attention. Past research indicates that sports related mental imagery practice improves athletic performance; however few studies to date have systematically included the characteristics of flow in their sports mental imagery interventions. The present study compared the efficacy of a "flow" and a standard basketball mental imagery intervention at improving performance on a basketball-shooting task. No significant differences were found between groups, but both reported increases in flow experiences.

Prologue

Positive psychology is a relatively new and vibrant subdiscipline that has generated considerable interest and research. It is concerned with how people derive happiness and enjoyment through their involvement with and interpretation of their environment. One area within positive psychology that has been especially interesting is the study of optimal experience and performance, or flow. Flow describes an optimal psychological state that presents itself in conjunction with optimal performance. Research has found that flow experiences are likely to occur when an individual perceives a challenge in their environment to match their ability to act. One environment that is conducive to flow experience is sport.

In an effort to improve athletic performance, some researchers have sought ways in which to increase flow experiences through mental practice techniques. Using very intensive analysis of very small samples, these researchers have concluded that the optimal mental state associated with flow can be accessed, and subsequently increased, through hypnosis. The present study is of a similar breed, as it intended to examine the possibility of increasing flow experience and improving basketball performance through the use of a "flow-specific" mental imagery intervention, but it also diverges from past research in eschewing hypnotic inductions. This paper will start with a discussion of flow in both non-sports and sports related contexts, followed by a discussion about mental imagery, especially in relation to sports, and will conclude with a discussion of the aims and hypotheses of the present study.

What is Flow?

Flow is an optimal psychological state that involves harmonious interaction between the mind and the body. When an individual is in flow they are completely immersed in their present activity and feel as though they are on top of the world. Flow is not something that we experience with great frequency, making the experience of it that much more special and memorable when it actually does happen. Researchers such as Mihalyi Csikszentmihalyi have set about investigating flow to understand what defines a flow experience and what factors are necessary in order for it to come about. The following nine components (Csikszentmihalyi, 1990) have been found to be both characteristics of a flow experience and necessary conditions if flow is to be experienced:

1-*A Challenge/Skills Balance*

In order for flow to occur, the activity that the individual is involved in needs to be perceived as challenging and require them to exercise their abilities to their capacity. When the challenges are perceived as too high for the individual, they are likely to experience anxiety. When the challenges are perceived as too low for the individual, they are likely to experience boredom. In situations where neither challenges nor skills are perceived, apathy emerges.

2-*A merging of action and awareness*

When all of a person's relevant skills are being exercised by the challenges of a situation, that person's awareness should be completely absorbed by that activity. This means that no mental energy should be left over to process any outside information. A wandering mind is not a characteristic of flow. The merging of action and awareness causes one to experience physical actions as effortless and natural.

3 & 4-*Clear goals and feedback*

In order for people to experience flow it is necessary that an activity present them with clear goals and feedback about their performance. Clear goals and feedback about performance insures that individuals are able to keep their minds focused on their task because they know what it is they are working towards and what changes, if any, they need to make to their performance. Some activities, such as creating art or writing music, lack clear feedback provided by a set of rules about the individual's performance on the task. If people want to experience flow while engaged in activities that are more creative and lack clear feedback, it is important that they develop a strong sense of what they want to do before engaging in the activity. In this way, they can set goals and recognize and gauge feedback for themselves.

5-*Concentration on the task at hand*

The quality of concentration characteristic of flow can be described as being so intense that one forgets all aspects of life outside of what they are doing at that moment. Therefore, in flow only a very small, select range of information is allowed into awareness, and this information is pertinent to the task that the individual is involved in. Unlike daily experience, in flow all the thoughts that may be troubling an individual are temporarily kept at bay, which is a very pleasurable experience.

6-*The paradox of control*

A flow experience involves an individual experiencing a sense of control, or more precisely, lacking the worry about losing control that is characteristic of most situations in our daily lives. What people experience in flow is not a sense of being in control so much as the ability to exercise control in difficult situations. Csikszentmihalyi (1990) states that it is not possible to experience a feeling of control unless one is willing to give up the safety of protective routines. "When a person becomes so dependent on the ability to control an enjoyable activity that he cannot pay attention to anything else, then he loses the ultimate control: the freedom to determine the content of consciousness" (Csikszentmihalyi, 1990, p. 69). In other words, in flow an individual lets go of the idea of being in control and experiences a state in which they feel as though they have great control.

7-*The loss of self-consciousness*

During a flow experience there is no room for self-scrutiny. The concept of the self slips below the threshold of our awareness, and due to this, the individual does not experience their environment as separate from themselves. When we are not preoccupied with definitions of ourselves, we actually have a chance to expand the concept of who we are. For example, a musician who is constantly worried about making a mistake while performing in front of an audience will not become immersed in their performance. This preoccupation will in turn block the musician from playing music at the top of their abilities. When a musician *is* completely engaged in their performance they will be able to exercise their abilities to their capacity, which according to Csikszentmihalyi (1990), will in turn allow them to expand their conception of self. According to flow philosophy, the loss of self-consciousness permits an individual to expand their meaning of self.

8-*The transformation of time*

In flow, most people report that time seems to pass much faster than it normally does. However, some individuals report that they experience time slowing down. It is not that the individual completely loses track of time, but that due to the extreme concentration, the merging of action and awareness, and the loss of self-consciousness, one is likely to experience time in a different manner. Therefore, it is not clear whether the transformation of time experienced in flow is a by-product of the intense concentration the activity at hand demands or whether it is something that comes about on its own.

9-*The autotelic experience*

If flow is to occur, the activity with which a person is involved must be intrinsically rewarding to that person. Csikszentmihalyi (1990) refers to this characteristic of flow as the "autotelic" (auto = self, and telos = goal) experience. "When experience is intrinsically rewarding life is justified in the present, instead of being held hostage to a hypothetical future gain" (p. 69). Therefore, flow experiences happen when an individual is engaged in an activity because it is in and of itself enjoyable to them.

Now that the nine conditions necessary for and the features of a flow experience have been outlined, it is necessary to discuss the relationship of flow to psychology.

Is Flow Important?

Research by Csikszentmihalyi suggests that flow experience is indeed very important to the quality of one's life. While it has been known for some time that money can't buy happiness, people still seem to think that materials will make them happy. Csikszentmihalyi's (1999) research, on the other hand, suggests that happiness depends upon whether a person is able to derive flow from whatever he or she does. He states that "people are happy not because of what they do, but because of how they do it. If they can experience flow working on the assembly line, chances are they will be happy, whereas if they don't have flow while lounging at a luxury resort, they are not going to be happy" (p. 824).

Using a method known as the experience sampling method (over a two-week period participants fill out rating scales and open ended questions on the cue of a beeper that goes off at random intervals), Csikszentmihalyi and LeFevre (1989) found support for this position on happiness. They discovered that situations characterized by high challenges and high skills were more than three times more likely to occur in work than in leisure (54% vs. 17%). Furthermore, they found that a number of positive affect variables were more related to whether or not an individual was in flow than the type of activity that person was engaged in. Participants in their study felt significantly more affectively positive, potent, concentrated, creative, and satisfied while in flow than they did when they were in other contexts but not in flow. Therefore, Csikszentmihalyi and LeFevre concluded that, because work provides us with more challenges and feedback about our performance than does our leisure time, the time we spend at work is more likely to result in us experiencing flow and feeling happy than is the time we spend in unstructured, non-flow conducive, leisure time.

This research is incredibly important as it can open people's eyes to the lack of enjoyment they derive from how they spend their leisure time. Thus Csikszentmihalyi and LeFevre (1989) suggest that people need to become aware of how many negative feelings they experience during their leisure time and understand how they can spend this time in a manner that might lead to flow experience, thereby increasing the positive emotions they experience in leisure. In referring to how people can find flow in their leisure time, Csikszentmihalyi (1999) recommends that people "find flow in activities that provide a potential for growth over an entire life span, allow for the emergence of new opportunities for action, and stimulate the development of new skills" (pg. 826), and furthermore that "when flow comes from active physical, mental, or emotional involvement-- from work, sports, hobbies, meditation, and interpersonal relationships-- then the chances for a complex life that leads to happiness improve" (p. 826). With that said, one type of leisure that is conducive to flow experience is sports.

Flow and Sports

Part of what is so special about sports is that they provide situations and realities that are distinct from ordinary life (Csikszentmihalyi, 1990). In sports, actions are governed by rules, and therefore there are goals to aim for and no shortage of direct feedback about one's performance. These characteristics of sports make flow especially likely to occur. To follow is an overview of the nine flow components in the context of athletics as defined by Jackson and Csikszentmihalyi (1999). Jackson (1992, 1996) validated the necessity of these components to experiencing flow in sports through the qualitative research of elite athletes and their flow experiences. Here are the previously discussed nine components of flow in the framework of sports:

1- *A challenge/skills balance*

In a situation that is conducive to flow, athletes will face a challenge that requires them to apply themselves to the capacity of their skills. When an athlete faces challenges that they perceive as exceeding their skill level they will experience states of anxiety. When an athlete perceives challenges as being too low for their skill level they will feel bored. Finally, when neither challenges nor skills are perceived, the athlete will experience apathy. The challenge/skills balance is just as sensitive in the sports domain as it is in other aspects of life. Jackson and Csikszentmihalyi (1999) state that the challenge/skills balance is not static, but that it is constantly moving upwards. This means that the athlete must continue to increase their skills and their challenges if they are to continue to maintain the ability to experience flow.

2- *A merging of action and awareness*

In sports, action and awareness merge only when an athlete becomes completely involved in their activity. The sensations an athlete experiences when this happens are described as feeling as though one is floating and feeling as though things are easy. There is a sense of lightness and ease of movement and greater oneness with the environment.

3 & 4- *Clear goals & feedback*

Athletes should set clear goals about their activities prior to performance if they wish to experience flow. This insures that the athlete knows what he or she is to do. This can be especially important when the game is on the line because it insures that on a moment by moment basis the athlete will know what to do next. Feedback in sports provides the participant with information about their performance, allowing for continuity through reinforcement as they pursue their goals. Jackson and Csikszentmihalyi (1999) state that athletes who are tuned into the feedback will be able to remain connected with what they are doing and in control of where they are headed.

5- *Concentration on the task at hand*

Tuning out distracting events from one’s surroundings and devoting one's attention to the task at hand is an essential job of athletes if they are going to experience flow in sports. This can be a significant challenge in sports as fans, other athletes, and coaches continually vie for the athlete's attention. Learning to stay in the present is an essential skill for athletes wanting to experience flow. When athletes' minds are filled with irrelevant thoughts, they are distracted from being fully immersed in what they are doing.

6- *The paradox of control*

More than actually being in control, athletes in flow know that they have the capacity for control. That is, they will put their trust in their skills and approach the task as a worthy challenge. This sense of belief in one's skills relieves worry about different possibilities, especially the possibility of failure. Worries of failure rarely enter the mind of an athlete in flow.

7- *The loss of self-consciousness*

An athlete in flow loses concern for the self and does not engage in worries or negative thoughts. This is because flow frees an athlete from self-concern and self-doubt. When an athlete is in flow they do not delegate attention to things that are not pertinent to the task at hand. Instead, all attention is focused on their activity and is held in place by clear goals and feedback. For example, a tennis player will not be in flow if they are devoting attention to the crowd or other distractions around them as they perform. They will lower their self-consciousness and increase their propensity to experience flow, however, if they have clearly defined goals for their performance that serve to keep their attention locked in on tennis and only tennis.

8- *The transformation of time*

Athletes either experience time as speeding up or slowing down while they are in flow. Jackson and Csikszentmihalyi state that for events that involve speed and require quick reactions, time will likely appear to lengthen in a flow state. In events that stretch out over a longer period of time, the athlete's total absorption in their sport may make the event seem to pass by at a much faster pace. These differences in experiences are likely due to the fact that shorter athletic events such as sprints require more technicality and extreme concentration for a brief period of time. Extreme concentration may create the illusion that time has expanded. Longer athletic events such as a basketball game require an athlete to have a prolonged concentration on a task, which may cause them to lose track of time and feel as though it has passed rapidly as they are consistently devoting their attention to the bigger picture as opposed to minor technicalities that are characteristic of more brief athletic events.

9- *The autotelic experience*

For flow to occur in sports, the activity must be participated in because it is inherently enjoyable for the athlete. That is, the activity must be intrinsically rewarding for them; participation should not be for extrinsic reasons if flow is to be experienced. For example, when an athlete participates in sports solely for extrinsic reasons such as public recognition and stardom, they are going to limit their ability to achieve optimal performance. This is because their feelings in respect to themselves and the game become contingent on external factors (such as recognition), and they lose focus on the enjoyment they can derive from the sport through completely immersing themselves in the activity. Experiencing flow is not contingent upon success or winning; even a member of a losing team can experience flow if they approach the activity in the right manner.

Flow Experience and Perception

One key concept of flow is perception. While perception is significant in determining the quality of experience in all realms of life, it may be especially important in determining whether or not an athlete experiences flow. Athletes who perceive their competition as more skilled are likely to experience anxiety even if they have equal or greater capabilities when objectively compared to their opponent. Similarly, it is possible for athletes to experience flow if they are able to perceive their abilities as sufficient to facing the challenges of their opponent even if their opponent is more skilled than they are when objectively compared. The ability to experience flow, therefore, suggests that an athlete has a degree of mental toughness that allows them to immerse themselves in an activity completely and not be distracted by negative thoughts and worries about failure. One way in which athletes can prepare their minds for competition and athletic performance is through the practicing of sports relevant mental imagery.

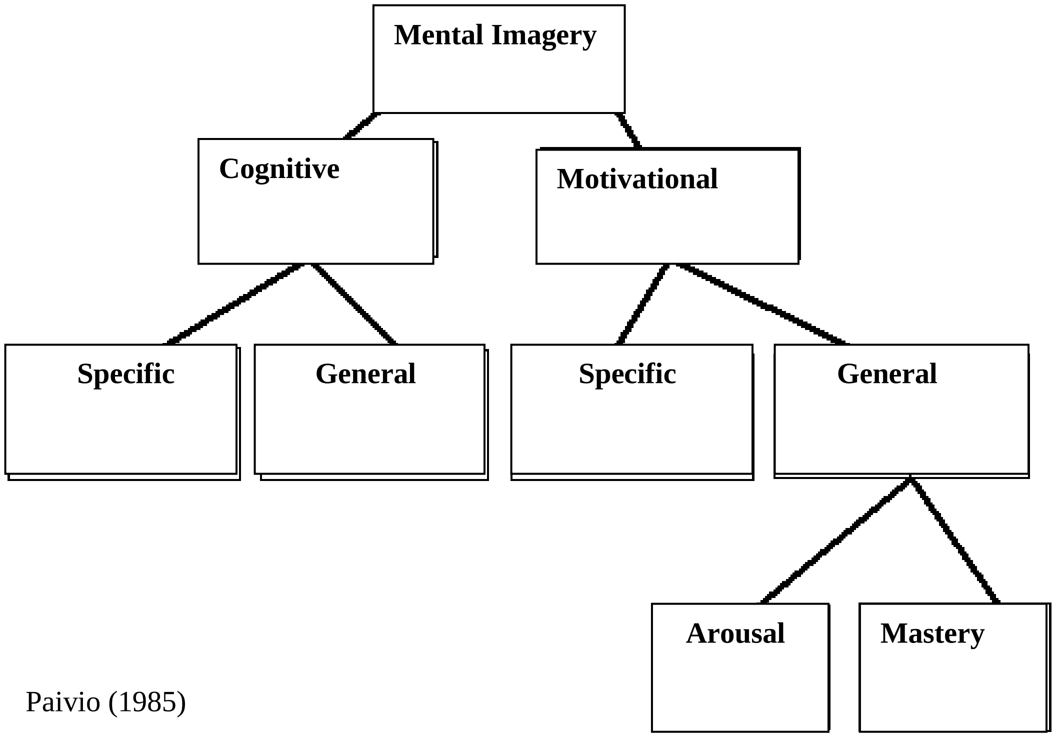
Mental Imagery

What exactly is mental imagery? According to Kosslyn (1994), mental imagery is a basic form of cognition, and it plays a central role in many human activities ranging from navigation to memory, to creative problem solving to thinking about the future. Mental imagery involves the cognitive rehearsal of a task in the absence of overt physical movement (Driskell, Copper & Moran, 1994). Basically, everything that we visualize is a form of mental imagery. But how is it that mental imagery can be used to improve athletic performance?

A popular theory for answering this question is known as the psychoneuromuscular theory (Jacobson 1931; Hale 1982). The theory posits that if movement is vividly imagined, minimal firings of the neural pathways corresponding to that movement occur and are recorded on a mental blueprint (Ziegler, 1987), thereby making that movement easier to perform in the future. Slade, Landers, and Martin (2002) had participants image bicep and tricep exercises, and they found that EMG bicep and tricep activity was significantly greater during the imagery session when compared to baseline. Although the EMG patterns of participants' arms during actual weight lifting differed from those recorded during the weight lifting imagery session, the weight lifting imagery EMG rating nonetheless suggested that mental imagery practice can have an effect on target muscles. Taken together, the psychoneuromuscular theory (Jacobson 1931; Hale 1982) and the research by Slade et al. (2002) suggest that mental imagery may be used to enhance performance. Research that has examined the intentional use of different kinds of mental imagery has found that different types of mental imagery serve different functions and that mental imagery practice may be engaged in differently depending upon an athlete's previous athletic experience. The next section will review this research.

Types and Characteristics of Mental Imagery

According to Paivio (1985), mental imagery has a cognitive or a motivational component. Paivio (1985) also states that the motivational and cognitive components of mental imagery break down to a specific and a general level. In other words, the cognitive domain breaks down into the cognitive-specific and cognitive-general forms of cognitive imagery, and the motivational domain breaks down into the motivational-specific and motivational-general components of motivational imagery. Mental imagery that is characterized as cognitive-specific involves the rehearsal of skills that are specific to a task (for example, the specific shooting skills that are necessary for a basketball player to make a free-throw shot). Cognitive-general mental imagery involves the rehearsal of strategies specific to an activity. An example of cognitive-general mental imagery is when a football player runs through the plays of their playbook mentally, and the intended strategies of those plays. Mental imagery that is characterized as motivational-specific involves imagining goals and the actions needed in order to achieve these goals. For example, a swimmer may imagine what it will take in order for them to achieve a desired time in the course of a season. Unlike the general level of cognitive-general imagery, motivational-general imagery breaks down into two smaller components: the motivational-general-arousal imagery (imagery associated with arousal and stress) and the motivational-general-mastery imagery (imagery associated with being in control, being mentally tough, and being self-confident) (Paivio, 1985). An example of motivational-general-arousal imagery is using imagery that portrays the intense nature of competition in order to get oneself aroused for competition, while an example of motivational-general-mastery imagery involves imagining oneself succeeding in the face of challenges presented by an opponent. Here is a diagram of these functions of mental imagery according to Paivio (1985):



Paivio (1985)

Munroe, Giacobbi, Hall and Weinberg (2000) state that when examining the functions of imagery, it is important to match the imagery used (CS, CG, MS, MG-A, MG-M) with the intended outcome. For example, if an individual wants to improve their performance on a specific skill they should practice mental imagery that is cognitive-specific in nature because cognitive-specific imagery involves the mental rehearsal of specific skills. On the other hand, if an individual feels sluggish prior to an athletic event, they would be well-advised to practice motivational-general arousal imagery as a means of increasing their arousal level. To illustrate this proposition by Munroe et al. (2000), Vadocz, Hall, and Moritz (1987) investigated the relationship between mental imagery use, competitive anxiety, and self-confidence, and in doing so found support for the differential effects of the distinctive types of mental imagery. Specifically, they found that participant engagement in motivational-general-arousal imagery was a significant predictor of participant cognitive anxiety as measured by Competitive State Anxiety Inventory-2 (Martens et al., 1990), supporting the notion that this type of imagery is associated with arousal. Vadocz et al. (1987) also found that athletes who engaged in motivational-general-mastery imagery had significantly higher levels of self-confidence, while the cognitive imagery was found to have no effect on participant self-confidence levels at all. In conclusion, Vadocz et al. (1987) state "…if cognitive state anxiety is a problem for a given athlete, then that athlete will probably make the situation worse by engaging in MG-Arousal imagery. However, if an athlete is having trouble getting motivated for a competition, then the use of MG-Arousal imagery might be helpful (p.248)." Hecker and Kaczor (1988) also found support for motivational-general-arousal imagery increasing arousal. They found that athletes' heart rates significantly increase above baseline levels when they used motivational-general-arousal imagery. In contrast, imagery that is not related to arousal, such as cognitive-specific imagery, appears to lack the stimulating characteristics that can increase arousal and heart rate. Furthermore, Munroe et al. (2000) cite studies that support the efficacy of cognitive-general imagery at helping athletes rehearse football plays, gymnastics routines, wrestling strategies, and slalom canoe races, but do not state that cognitive-general imagery increased arousal. All in all, the research suggests that different types of mental imagery can have different effects on the mental imagery practitioner, which suggests that the type of mental imagery an individual practices should be chosen depending on the type of outcome they hope to achieve.

Mental Imagery and Sports

When practicing mental imagery, athletes can adopt either an external or internal perspective. An external or "third person" perspective describes when an athlete sees him or herself from a distance, as though they are watching themselves perform the task. An internal, or "first person" perspective describes when the athlete sees him or herself acting as if they were actually doing the activity at that time, through their own eyes. Research has found that athletes who adopt the internal perspective may experience more kinesthetic sensations during mental imagery practice (Hall & Erffmeyer, 1983). However, there has been conflicting research as to whether the practice of the internal or external perspective is associated with better athletic performance (Mahoney & Avener, 1977; Rotella, Gansneder, Ojala & Billing, 1980; Highlen & Bennet, 1979; Meyers, Cooke, Cullen & Liles, 1979). Research has suggested, however, that kinesthetic imagery ability improves as a function of athletic ability, with more elite athletes employing the internally focused perspective. In a study of over 700 athletes, Mahoney, Gabriel, and Perkins (1987) found that when compared to their non-elite peers, elite athletes incorporate more internally focused and kinesthetic imagery. This suggests that mental imagery practice from the "first person" may be related to higher athletic performance.

Hall, Rodgers, and Barr (1990) found that athletes who compete at higher levels report using significantly more mental imagery than do athletes who compete at lower competition levels. The athletes who competed at lower levels also reported using significantly less imagery during competition and practice than did the more elite athletes. The more elite athletes were also more likely to use imagery before a competition than the lower competitive level athletes, and they were also more likely to use mental imagery outside of competitive or practice situations than the lower competitive level athletes. Hall et al. (1990) also found that the higher competitive level athletes found it easier to visualize an entire skill than did the lower level athletes and that the higher level athletes structured their imagery sessions more than the lower level athletes. Finally, the athletes in Hall et al.'s (1990) study were asked whether or not they employed imagery prior to their "all-time best performance" and found that the more skilled athletes retrospectively reported that they had employed significantly more mental imagery practice prior to this all-time best performance than the less-skilled athlete group. Hall et al. (1990) offer the suggestion that the discrepancy between imagery use and competitive level exists because athletes at higher competitive levels have made substantial commitments to their sports and therefore invest a significant amount of cognitive activity, including imagery, to this aspect of their lives.

While research has found that there are different types of mental imagery and that athletes who compete at higher competitive levels engage in more mental imagery practice, it is essential to ask whether support has been found for mental imagery practice having the ability to improve performance in sports. Woolfolk, Parrish, and Murphy (1985) found that when athletes imagined themselves successfully completing a golf-putting task, their performance significantly improved from their baseline performance. Furthermore, athletes who were assigned to a negative imagery group— that is, their group imaged themselves missing the golf putt—their performance was found to significantly decrease from baseline to post-test. This study suggests that mental imagery content indeed can have an effect on performance outcomes.

A whole host of mental imagery studies have examined the efficacy of cognitive-specific sports imagery (and slight variations thereof) at improving athletic performance (Hall & Erffmeyer, 1983; Woolfolk et al., 1985; Ziegler, 1987; Wrisberg & Anshel, 1989; Onestak, 1997). The majority of these studies have been conducted in the context of golf and basketball performance. Furthermore, these studies have typically involved a relaxation induction in conjunction with the mental imagery practice, and some have included the use of a behavioral model from which participants can observe how to successfully complete a sports related task (i.e., a free-throw shot). In 1989, Wrisberg and Anshel compared the performance of forty boys on a basketball free-throw shooting task. The researchers were interested in whether certain pre-shot strategies might improve their free-throw shooting performance. Participants were randomly assigned to a control group, a relaxation only group, a mental imagery only group, or a relaxation + mental imagery group. At post-test, participants in the relaxation + mental imagery group performed significantly better than they had at pretest, and furthermore they performed significantly better than the other two groups at post-test. Their study therefore supported the use of their relaxation + mental imagery technique as a valid "pre-free-throw" shooting technique that may be used to enhance performance.

Ziegler (1987) examined how different kinds of imagery styles influenced her participants' performance on a basketball free throw shooting task. These imagery styles included passive imagery, defined as the use of vivid imagery of the environment, the task, and successful completion of the task; active imagery, defined as the incorporation of appropriate movements with the images; and passive imagery with physical practice, defined as having the participant imagine the successful completion of a task prior to the execution of the task. Participants in her study were randomly assigned to one of these three imagery conditions, to a physical practice only group, or to the control group (no practice between pre-test and post-test). Post-test data analysis revealed that the active imagery group, passive imagery group, and the passive imagery with physical practice group achieved significant gains in performance from pre-test to post-test, while the physical practice only group remained relatively stable in performance. Furthermore, the control group did not make any significant gains in free-throw shooting performance between tests, lending further support to imagery practice as an effective means of enhancing performance.

Hall and Erffmeyer (1983) employed visuo-motor behavior rehearsal (VMBR), a technique that combines mental imagery, relaxation, and behavioral modeling. The behavioral model in their study was a video that demonstrated to participants how to correctly shoot a free throw. Participants not assigned to the VMBR condition were assigned to a relaxation and mental imagery only condition. The intervention lasted two weeks, after which a five-day fading period was implemented to insure that participants were not overly relying on the video. The results of the post-test revealed a significant difference between the VMBR group and the relaxation + mental imagery group, with the VMBR group showing significant improvement in free-throw shooting performance. Onestak (1997) repeated the design of this study but did not find any of the conditions to be more effective at improving free throw shooting performance than another. Across all conditions his participants showed free throw shooting improvements. Whether or not a behavioral model is necessary in conjunction with mental imagery practice remains in question.

Mental Practice, Athletic Performance and Flow

Research that has explored the efficacy of mental strategies at increasing flow experience in sports is relatively new and a great deal of it involves the use of hypnosis and trigger control techniques. In these studies, athletes are inducted into a state of hypnosis and then are asked to recall a time when they experienced flow. After vividly re-experiencing this previous flow experience, participants are told to pair these feelings with an environmental trigger. A trigger can be a word, music, or an object, and it serves as a means through which individuals can re-experience the qualities of their flow occurrence. In hypnosis theory, when the trigger is presented in a non-hypnotic state, it will help that individual re-experience the state with which the trigger is paired.

In 1991, Schreiber examined whether a season-long hypnosis intervention on collegiate basketball players could improve the players' ability to concentrate on the act of shooting and in turn increase performance. In his participant pool of both male (N=10) and female (N=12) collegiate basketball players, he found that after four weeks into the basketball season the participants in the hypnosis group showed higher cumulative points when compared to players in the control group. Schrieber (1991) states that six out of the eight participants in the men's hypnosis group had higher cumulative shooting points when compared to the men's control group, and that four of six participants in the women's hypnosis group scored higher than the participants in the women's control group on shooting. However, no statistical tests of significance were described, leaving his comparative findings interesting but unreliable. Furthermore, two participants dropped out of his men's control group and the construct of flow was not examined.

In 2000, Pates and Maynard examined the effects a hypnotic induction intervention had on flow states and the golf chip-shot performance of three participants. The hypnotic intervention involved a training session in which the participants practiced a relaxation technique, were inducted into a hypnotic state, were guided through hypnotic regression, and were asked to develop a trigger for re-experiencing the hypnotic state. Participants received a recording of this initial training phase and were asked to listen to the hypnotic induction recording between the baseline 1 and intervention phases. At intervention evaluation, the participants were asked to imagine their "trigger" (in this case participants paired a memorable musical composition with their hypnotic state) and were asked to incorporate that trigger each time they performed a shot. Participants' performance on the golf chip-shot task was assessed (as measured by centimeters from the pin) and participants recorded their feelings of flow as measured quantitatively by Jackson and Marsh's (1996) Flow State Scale. The three participants in the study showed improvements in their golf chip-shot performance during the intervention, and two of the three participants also showed increases in flow intensity during the intervention. Unfortunately, Pates and Maynard (2000) did not use a control group and their participant sample was incredibly small.

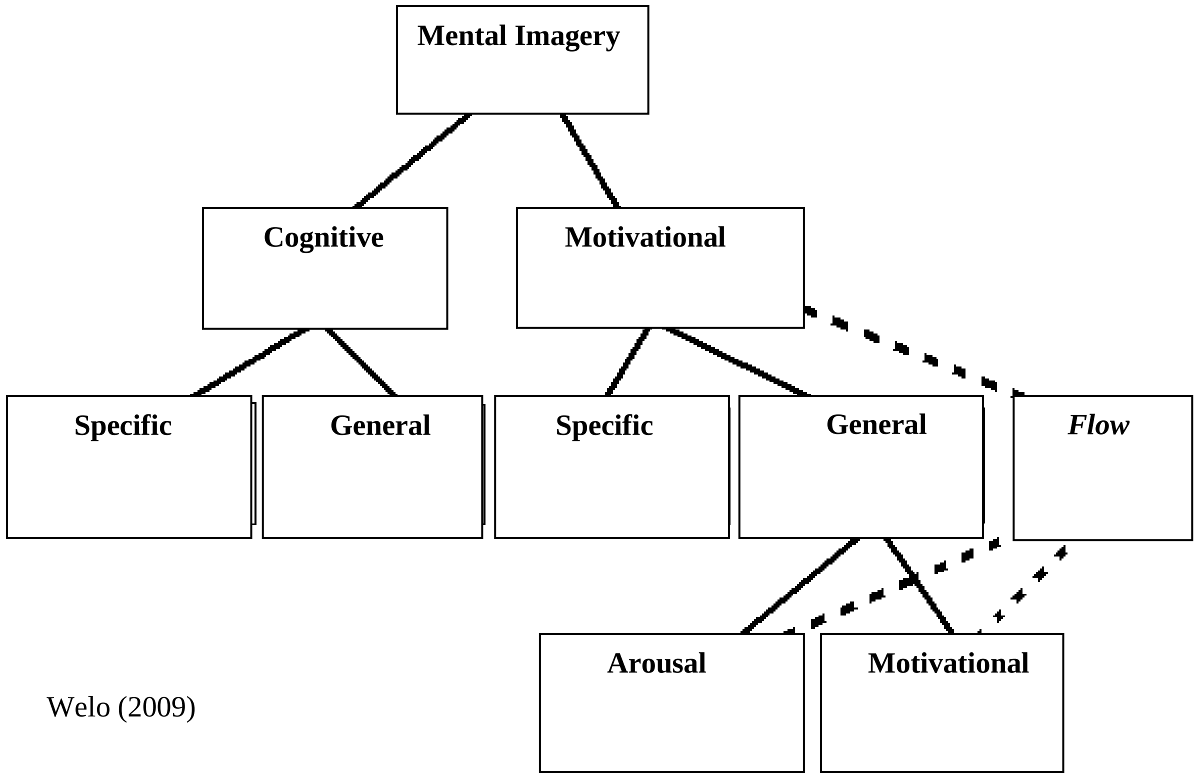
In 2001, Pates, Oliver and Maynard examined the effects of the same hypnosis intervention on golf putting performance in a participant sample of five competitive golfers. Again, no control group was used and the participant sample was again incredibly small. However, the results of their study indicated that all five participants increased their mean golf putting performance (as measured by centimeters from the pin) and that all five of the participants experienced increased flow scores as measured by Jackson and Marsh's (1996) Flow State Scale.

Finally, in 2002, Pates, Cummings and Maynard turned their attention to the efficacy of a hypnosis intervention at increasing flow experience and three-point shooting performance of collegiate basketball players. Again, their sample size was very small (five participants) and there was no control group in their study. Pates et al. (2002) hypothesized that their hypnosis intervention would be effective at facilitating access to flow states and increasing performance at basketball three-point shooting. For all five participants, the hypnosis intervention technique led to an increase in three-point shot performance accuracy. Furthermore, all five participants experienced increases in self-reported flow experiences as measured by the Flow State Scale (Jackson & Marsh, 1996). Pates et al. (2002) concluded that the hypnosis intervention of their study was effective at enhancing basketball three-point shooting performance and that flow states may be "accessed" using hypnotic regression and trigger control techniques.

It is important to note that while hypnosis is a form of mental practice and that while hypnotized an individual may practice mental imagery, hypnosis differs from the mental imagery practice previously discussed in that a hypnotic state is not necessary in order for mental imagery practice to be effective. In 2005, Nicholls, Polman and Holt designed a study similar to the hypnosis intervention studies of Pates et al. (2000, 2001, 2002), but instead of using a hypnotic intervention these researchers examined the effects of mental imagery interventions on the intensity and frequency of flow states and golf performance. In their mental imagery intervention, Nicholls et al. (2005) utilized motivational-general-mastery imagery because, out of all of Paivio's (1985) imagery types, it is most similar to flow. During the intervention, the participants imaged themselves during pre-shot preparation, hitting the shot, feeling confident and mentally tough about their performance, and recovering quickly after a poor shot. The results of their study indicated that three of the four participants experienced increases in the intensity of their flow experiences following the imagery intervention, and that all four of the participants in their study experienced increases in their flow frequency and golf performance following the mental imagery intervention. While this study is limited by its small participant population and lack of a control group, it presents preliminary support for the use of mental imagery as a technique for increasing flow experience and continues to support the other research that suggests that mental imagery is effective at improving athletic performance.

The present study

Similar to Nicholls et al.'s (2005) study, the present study sought to examine the effects of mental imagery on flow intensity as measured by the Flow State Scale (Jackson & Marsh, 1996) and on participant performance on a timed basketball-shooting task. The present study expanded upon past research in that it utilized two different types of mental imagery interventions. The first imagery intervention was cognitive-specific in nature and was designed to strictly adhere to guiding the participant through the rehearsal of specific basketball shooting skills. As Munroe et al. (2000) note, cognitive-specific imagery involves the imagined rehearsal of specific sport skills. The second mental imagery intervention is both related to and expands upon past mental imagery interventions. This mental imagery intervention involved the use of "flow-specific" mental imagery and asked the participant to recall a past experience of flow and to apply the feelings associated with this experience to their flow-specific mental imagery practice. The design of the flow related mental imagery intervention was based upon Csikszentmihalyi's (1990) nine components of flow discussed earlier and is closely related to motivational-general-mastery imagery in that it involved the participant imaging themselves behaving in a confident and successful manner while engaged in a basketball shooting task. The flow imagery intervention is also related to motivational-general-arousal imagery in that it required the participants to recall a time they experienced flow and to incorporate these past feelings associated with that episode into their mental imagery practice. Therefore, the flow imagery intervention is most similar to the motivational-general imagery of Paivio's (1985) mental imagery diagram (i.e., a combination of MGA and MGM imagery types), but it is different from standard motivational-general imagery in that an introduction to flow was given at the beginning of the imagery session, and the imagery intervention incorporated other aspects of flow psychology (concentration on the task at hand, clear feedback, merging of action and awareness, challenge/skills balance) throughout the course of the recording. Therefore, the flow imagery of the present study has been recognized as similar to, but different from, other types of mental imagery. Here is a visual depiction of where the flow mental imagery intervention fits within Paivio's (1985) mental imagery chart:



In contrast to past studies that have examined the efficiency of mental practice at enhancing athletes' performance and flow experiences, the present study presented participants with a challenging situation under which their basketball performance was tested. According to Csikszentmihalyi (1990), if flow is to be experienced, an athlete must perceive the activity in which they are participating as providing them with sufficient challenges. The present study attempted to do so.

I hypothesized that participants in the flow imagery intervention group would experience greater flow intensity from baseline to post-test examination as measured by the Flow State Scale (Jackson & Marsh, 1996) and that they would also show greater performance increments when compared to participants in the cognitive-specific imagery group. I also hypothesized that participants in the cognitive-specific imagery group would show shooting performance improvements between baseline and post-test, lending support for past research that has found similar results.

Method

Participants

The participants of the present study were members of the Macalester College men's (N= 13) and women's basketball teams (N=12) and male students interested and involved in informal recreational basketball (N=8). The participants were between the ages of 17 and 23, and predominantly Caucasian. The researcher, who plays on the men's basketball team, recruited participants. Three members of the men's basketball team were dropped from participation in the present study due to injury or extraneous circumstances that caused them to miss post-intervention testing. Therefore there were 10 members of the men's basketball team that fully participated in the present study.

Measures

The Flow State Scale (Jackson & Marsh, 1996) is a 36 item self-report scale that measures the intensity with which an athlete experiences flow. The FSS uses a 5-point Likert rating scale, and it incorporates all nine components of Csikszentmihalyi's (1990) definition of flow as subscales. These sub-scales of the FSS represent the challenge-skills balance, the merging of action and awareness, the provision of clear goals, receiving unambiguous feedback, the individual's concentration on the task at hand, a sense of control, a loss of self-consciousness, a transformation of time, and the autotelic experience. The scale has good reliability (alpha = .83). In 2002, Pates et al. utilized the FSS to measure the effect their hypnosis intervention had on their participants flow experience intensity.

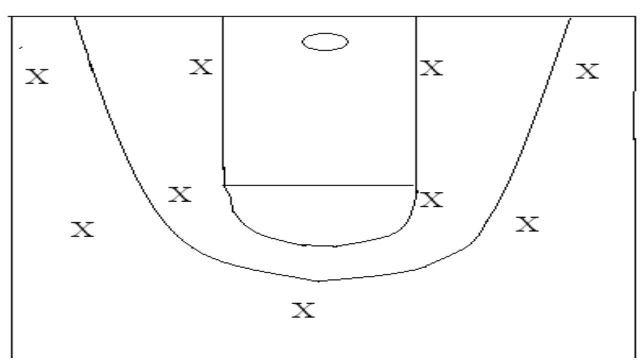
The Brief Fear of Negative Evaluation Scale (Leary, 1983) is a twelve-item measure that uses a five-point Likert rating scale to measure the amount of apprehension individuals experience in feeling that others could negatively evaluate them. Leary (1983) found the scale to have a Cronbach's alpha of .90. Watson and Friend (1969) initially designed the scale, but Leary (1983) downsized the original 30-item scale and found it to have nearly identical reliability as a 12-item scale. It was used in this study to take into account the amount of apprehension the participants may have felt due to the researcher's presence during their shooting task.

Finally, the researcher recorded participant performance on a basketball-shooting task at pre-intervention and post-intervention. During the shooting task, participants were given two minutes to attempt to make one or two shots from a series of locations on the basketball court prior to moving on to the next shooting location. There were a total of nine spots from which the participants had to make one or two shots, and they were given a two-minute time limit within which to complete the task. Performance on this shooting task was determined based upon the number of shooting spots out of nine completed, and the number of shots made out of shots attempted. Participants who completed the task under the two-minute time limit received bonus points for having done so.

Experimental manipulation

All participants underwent a baseline evaluation of their performance in a basketball-shooting task. The basketball-shooting task consisted of participants having to make one or two shots from a series of designated locations on the basketball court (see Image 1) within a two-minute time frame. Shooting task performance was determined by summing the number of successful shots (maximum=13) and adding a bonus for those who completed the task quickly. The bonus was computed by subtracting the participant's time on the task from the maximum time (120 seconds) and dividing by 10. Thus participants received one extra bonus point for every ten seconds by which they beat the deadline. Here is the written version of this formula: score= # shots made + [(120-participant time) ÷ 10]. After this baseline assessment, the participants were randomly assigned to either the cognitive-specific mental imagery group (group A, see appendix A) or the flow mental imagery group (group B, see appendix B). Participants were given their corresponding mental imagery CD and a practice log and were asked to return for reassessment exactly one week from their baseline testing date. During this week-long period between baseline and post-test, the participants were instructed to listen to their audio CD once daily. Exactly one week after the baseline-shooting task, participants returned individually to the gym to participate in the post-intervention shooting task. The post-intervention shooting task was identical to the baseline-shooting task, and performance was assessed using the same formula that was used for the pre-test scoring.

Image 1.



Shooting task: There was a two-minute time limit. The participant's goal was to make two shots from each spot within the three-point line and one shot from each spot outside of the three-point line within a two minute time period. The shooting task moved in this order: right block, left block, left elbow, right elbow, right baseline, right elbow extended, left baseline, left elbow extended, top of the key.

The mental imagery interventions

The researcher created both the cognitive-specific and flow mental imagery interventions in the present study. The flow mental imagery recording was based upon the nine major tenets of flow (Csikszentmihalyi, 1990) and was ten minutes and thirty seconds in length. The cognitive-specific audio recording was designed to focus solely on the mental rehearsal of skills associated with basketball shooting, and was eight minutes and fifty-one seconds in length. A conscious effort was made to differentiate the two mental imagery recordings from one another. The practice of specific skills associated with basketball shooting was omitted from the flow mental imagery recording, while the cognitive-specific mental imagery recording did not have participants recall a time of optimal performance nor did it ask them to incorporate a mindset of optimal performance into their mental imagery practice.

Results

I first sought to determine whether the participants in the mental imagery conditions began the study with equivalent levels of basketball skill. To do this, I compared the pre-intervention performance on the shooting task for the two mental imagery groups using a t-test. The cognitive-specific mental imagery group ($N=16$) had an average score of 12.3 ($SD = 2.98$), while the flow imagery group ($N=14$) had an average score of 10.6 ($SD=1.99$). While members of the cognitive-specific group tended to perform better at pre-intervention, these differences were only marginally significant ($t(30)= 1.97$, $p=.06$).

Performance improvement was assessed by subtracting pre-test scores from post-test scores; positive scores indicated enhanced performance, and negative scores indicated a decrement in performance. Performance remained essentially unchanged in the cognitive-specific mental imagery group ($M=-.16$, $SD=2.02$) between pre-test and post-test, while a slight performance improvement occurred in the flow mental imagery group ($M=1.1$, $SD=1.95$). These differences, however, were only marginally significant ($t(28)=-1.73$, $p=.09$).

To insure that the cognitive-specific and flow mental imagery groups did not differ in their flow scores at pre-intervention, I compared their group means with a t-test. At pre-intervention testing, there were no statistically significant differences in flow scores as measured by the Flow State Scale between the cognitive-specific mental imagery group ($M=133.81$, $SD=20.32$) and the flow mental imagery group ($M=131.39$, $SD=21.81$), ($t(28)=.32$, $p=.99$). Furthermore, flow scores did not differ between the cognitive-specific imagery group ($M=140.2$; $SD=22.54$) and the flow imagery group at post-test ($M=139.5$; $SD=22.7$) ($t(27)= .62$, $p=.42$). However, a Mixed Model ANOVA revealed that both groups evidenced a statistically significant increase in flow scores for both groups between pre-intervention and post-test [$F(1,27)=6.95$, $p=.01$].

Since the fear of being negatively evaluated can impair optimal athletic performance, I examined whether the mental imagery groups differed significantly on their scores on the Brief Fear of Negative Evaluation Scale (Leary, 1983). I found that scores on the BFNES did not differ significantly between members of the cognitive-specific mental imagery group ($M=35.81$, $SD=6.23$) and the flow mental imagery group ($M=32.92$, $SD=7.65$), $t(28)=1.13$, $p=.66$). Furthermore, scores on the BFNES did not significantly correlate with pre-intervention scores on the Flow State Scale ($r(30)=-.26$, $p=.16$), pre-intervention basketball shooting performance ($r(30)=-.06$, $p=.74$), post-intervention scores on the Flow State Scale ($r(29)=-.03$, $p=.89$), or post-intervention shooting performance ($r(30)=.10$, $p=.89$). Thus fear of negative evaluation was unrelated to the study's key variables and will not be included in any subsequent analyses.

I also examined correlations between the studies variables and found some significant, though not necessarily surprising, results. Pre-intervention scores on the Flow State Scale were strongly correlated with pre-intervention scores on the shooting task ($r(30)=.55$, $p\leq .01$). Similarly, post-intervention flow scores were correlated with post-intervention scores on the shooting task ($r(29)=.41$, $p\leq .005$). Post-intervention flow scores were also significantly correlated with pre-intervention flow scores ($r(29) = .67$, $p\leq .01$). Pre-intervention shooting performance scores were strongly correlated with post-intervention shooting performance ($r(30)=.68$, $p\leq .01$), and improvement between pre-intervention and post-intervention was negatively correlated with pre-intervention shooting performance ($r(30)=-.49$, $p \leq .01$). Improvement on the shooting task and post-intervention shooting scores were marginally correlated ($r(30)=.30$, $p=.1$). The number of times a mental imagery intervention was practiced by the participant did not appear to have an effect on post-intervention scores on the shooting task ($r(30)=.26$, $p=.17$), improvement from pre-intervention to post-intervention ($r(30)=.13$, $p=.51$), or post-intervention scores on the Flow State Scale ($r(29)=.17$, $p=.37$).

In order to control for gender differences, I compared the scores of males and females in the study. In general, my findings indicated that females outperformed males on both pre-test basketball shooting performance and post-test basketball shooting performance. Male participants (N=18) had a group mean of 10.87 (SD=2.28) at pre-intervention, while female participants (N=12) had a group mean of 12.60 (SD=2.95). At post-intervention testing, male participants had a group mean of 11.28 (SD=1.99) while female participants had a group mean of 13.05 (SD=2.74). Interestingly, there were no significant gender differences in flow experiences at both pre-test and post-test.

I also ran an analysis that focused only on the participants who played basketball at the collegiate level in order to determine whether college basketball experience would change the initial results of the study. Among the individuals who played college basketball, there were a total of 12 participants in the cognitive-specific imagery group and 10 participants in the flow imagery group. Similar to previously described results, there were no significant differences between these groups on pre-intervention performance or scores on the flow state scale at pre-intervention and post-intervention. However, collegiate basketball participants in the flow mental imagery group (M=1.14, SD= 2.3) did not differ significantly from the cognitive-specific group (M=-.108, SD=2.14), t(20)=-1.315, p=.627, although the means were in the same direction as in the analyses with all participants.

Discussion

Hypothesis #1

The hypothesis that participants in the flow mental imagery condition would show greater improvements at post-test on the basketball-shooting task was only marginally supported in the present study. While the flow mental imagery group did show a greater group performance improvement between pre and post-test than the cognitive-specific group, this is likely due to the cognitive-specific group experiencing a ceiling effect in their performance at pre-test. The mean group score of participants in the cognitive-specific group at pre-intervention testing indicates that nearly all of the participants in this group neared completion of the shooting task within the two-minute time frame. The opposite was true for the flow mental imagery group at pre-test. Further analysis revealed that performance improvement between pre and post-test was negatively correlated with pre-test performance. It therefore appears as though the members of the cognitive-specific imagery group performed at the top of their abilities at pre-test to a greater extent than did the members of the flow mental imagery group. Therefore, the ceiling effect displayed by the cognitive-specific group at pre-testing may explain the marginally significant difference in performance between the two conditions. This needs to be taken into consideration when interpreting the study's results.

Hypothesis #2

The second hypothesis of the present study was that the flow mental imagery group would experience greater increases in their flow experiences than the cognitive-specific group. This hypothesis was based upon the fact that the flow mental imagery group's intervention was designed specifically to incorporate the nine characteristics of flow (challenge/skills balance, merging of action and awareness, clear goals and feedback, concentration on the task at hand, the paradox of control, the loss of self-consciousness, the transformation of time, and the autotelic experience); the intervention was thus designed to enhance participants' experience of flow at post-testing relative to the cognitive-specific group. The present study did not support this hypothesis, as both the flow and cognitive-specific mental imagery groups showed statistically significant increases in their flow experiences. Why this happened is up for speculation. Past research that has examined the ability of *hypnosis* interventions to increase flow experience and sports performance has also noted an increase in flow scores after intervention (Pates & Maynard, 2000; Pates et al., 2001; Pates et al., 2002). These studies, however, have not employed a "non-flow" hypnosis intervention as a form of comparison. My explanation of this finding is that the mental imagery practice may have helped the participants develop more concentration or focus, which are key components of flow. It could also be that the repeated use of the Flow State Scale (Jackson & Marsh, 1996) caused the participants to develop an attunement to their flow-like experiences, thereby increasing their propensity to report higher levels of flow at post-intervention testing.

The cognitive-specific mental imagery intervention may have inadvertently incorporated characteristics of flow. One flow characteristic that may have been present in the cognitive-specific imagery intervention is clear goals and feedback. Participants in this group were guided through a visualization process that involved them consistently making shots and successfully completing various types of basketball shooting mechanics (See Appendix A). This reinforcement, albeit unintentional, may have increased flow scores at post intervention. One further explanation of the increase in flow scores among members of the cognitive-specific group is the nature of the basketball-shooting task. As indicated by shooting task performance means between imagery groups, the majority of participants came close to but did not completely finish the shooting task within the two-minute time limit. This suggests that the task embodied the challenge/skills balance quality of flow. Furthermore, participants may been motivated to beat their pre-intervention score on the shooting task at post-testing, which in turn may have contributed to greater subjective experiences of flow and higher reports of flow experience on the Flow State Scale.

Hypothesis #3

Though not directly hypothesized, the present study assumed that the number of times a mental imagery intervention was practiced would have a significant effect on post-intervention basketball shooting performance. The correlation between the number of times participants reported practicing their mental imagery intervention and their post-intervention shooting-task score was not significant, however. While the possibility exists that the mental imagery interventions of the present study were completely ineffective at improving shooting performance, it is also important to consider other variables such as participant motivation and reporting bias.

Participant Motivation

The researcher asked for a significant investment from his participants, and the majority of them partook in the study as a means of helping the researcher with his honor's project. Their well-intentioned but extrinsic motivation likely played a key role in determining the number of times they practiced their mental imagery intervention and the amount of attention they devoted to this exercise when they did practice. In hindsight, this variable should have been controlled for and will need to be more carefully monitored in future studies. In comparison to past studies of this sort, the intervention phase of the present study was more independent, and more trust was put in the participants to practice their mental imagery intervention on their own. In comparison to the intervention procedure utilized by Pates, Cummings, and Maynard (2002), the present study recruited more individuals for participation and was less hands-on in regard to the application of the intervention. For example, in Pates et al.'s (2002) study, participants participated in a baseline evaluation of their three-point shooting performance and then engaged in an hour long hypnosis intervention that was designed to help them pair their memories and feelings associated with past flow experiences with the image of a basketball. This hypnosis session was audiotaped and a personalized copy of the individual hypnosis session was given to each participant (N=5). Unlike the present study, Pates et al. (2002) required participants to visit the researchers daily and to listen to their individualized audio recording in the researchers' presence. After seven days of this observed practice, Pates et al.'s (2002) participants returned and were reassessed on their shooting performance. Because of the number of participants in the present study and the demands of other college coursework, the researcher was unable to provide as much individual guidance as past researchers such as Pates et al. (2002) have provided for their participants. This may have in turn caused participants in the present study to be less diligent in their mental imagery practice or to not feel like practicing their mental imagery intervention at all. Future studies of this nature may benefit from providing more practice guidance for participants or by controlling for participant motivation.

Some participants in the present study expressed motivation to both beat their previous score from the pre-test and/or to beat a score attained by a friend or teammate. The latter type of competition was not intended to occur, though it was a somewhat inevitable side effect due to the close relationships among the participants. Thus, motivation to beat the performance scores of others should have been assessed and controlled for because such motivation may have influenced a participant's ability to focus on their own basketball improvement in the study. Additionally, this form of extrinsic motivation is not related to the "autotelic experience" component of flow (Csikszentmihalyi, 1990), and participants who had high levels of extrinsic motivation may have unintentionally hampered their own ability to experience flow. Future studies should measure extrinsic motivation at pre-testing and downplay inter-participant competition. If some participants are found to be highly extrinsically motivated, researchers might be able to apply their understanding of flow psychology to help the participants develop intrinsic motivation in regards to their participation in sports. This could help them derive more enjoyment from athletics in the future.

Exploratory Analyses

The results of my study indicated that the female participants outperformed the males on both pre-intervention and post-intervention shooting task performance. This finding held true when the non-college basketball-playing males were excluded from analysis as well. This finding is especially interesting to note because it is related to the seasonal success of the teams; the women's basketball team (11-14) experienced significantly more success during the season than the men's basketball team (0-25). While this is an interesting relationship, it is important to consider that the ongoing seasonal losses had a negative psychological effect on the male college basketball participants in the present study, which in turn could have impeded their performance on the shooting task. Furthermore, the head women's basketball coach had recommended to her players that they participate in the study, and regularly endorsed the use of mental imagery practice as a means of improving free-throw shooting performance throughout the course of their season. This endorsement may have increased female participants' motivation to practice their mental imagery intervention more frequently and with greater attention. The men's head basketball coach made no such endorsement. This variable of "coach endorsement" represents the start of a long list of research confounds experienced in the present study.

Research Confounds

The role of the researcher is an important variable to consider. As a teammate, friend, acquaintance, and classmate of all of the participants in the present study, the role of the researcher may have contributed to unreliable research findings. Given the close interpersonal nature of many of the participant-researcher relationships, the participants may have felt an obligation to help the researcher with his study rather than engaging in the mental imagery practice as a means of improving their own basketball performance. Furthermore, the nature of the relationship between the participants and the researcher may have contributed to inaccurate reports regarding the number of times the mental imagery intervention was practiced. Following post-test on the shooting task, numerous participants verbally expressed their apologies to the researcher for not having improved between pre and post intervention. This sense of failure or of having let down the researcher may have led participants to inflate their scores on the Flow State Scale

(Jackson & Marsh, 1996) at post-intervention. The motivation to do this may have been especially strong among the participants who did not show an outward improvement in their shooting performance. In an effort to compensate for a lack of objective improvement, some participants may have overestimated their flow experiences at post-test. With this said, future research of this sort should make sure that there is not a preexisting relationship between the participants and the researcher, as participants may be motivated to help the researcher out in ways that unintentionally confound the data.

There were a number of other research confounds in the present study. Because all of the participants and the researcher were full-time students, scheduling times for the shooting performance testing presented many difficulties. As a result of this, participants engaged in the study at various hours during the day, and at times that were convenient for both them and the researcher. Unfortunately, however, this often meant that members of the men's and women's basketball team had completed a full-team practice prior to the shooting task or had participated in a weight training program within a close proximity to their shooting task test. Such physical fatigue is not conducive to performance improvement or flow experience. In addition to this confound, the basketball gym was regularly occupied by other athletes who may have unintentionally distracted participants from their focus on the shooting task. Other distractions that were encountered at times during shooting assessment included the playing of music in the gymnasium and cheering directed towards a participant from friends. These research confounds were difficult to control as the gym is a public space, and people were regularly coming in and out of the gymnasium during a shooting performance test. Future studies of this nature would benefit from having a private or reserved court space in which the participants can perform without environmental distractions. On the other hand, however, the environmental distractions that participants sometimes encountered during performance testing may not have been a research confound but a further test of the participants experience of flow. "Concentration on the task at hand" is an important characteristic of flow, and it could be argued that participants who were truly experiencing flow would not have been effected by non-relevant environmental distractions anyway. The flow mental imagery intervention specifically had participants imagine themselves in a crowded gym and practice focusing only on their basketball performance (See Appendix B). Therefore, the distractions that were sometimes present in the basketball gym were somewhat controlled for among the participants in the flow mental imagery group due to the content of the flow mental imagery intervention. Future studies might wish to expand upon this through the inclusion of background noises and distractions characteristic of a sports environment (i.e., cheering and booing) in the mental imagery intervention. Doing so might serve to improve participant focus and increase flow at post-intervention testing.

In an ideal world, the participants of the present study would have all participated in the mental imagery intervention during the same time of the year. Unfortunately, this was not possible due to the demands of college coursework and other life events on both the participants and the researcher. However, some of the participants who played college basketball were tested during the colleges' winter break, which may have allowed them more time to focus on their mental imagery practice. The majority of participants, however, participated in the study during the academic semester and thus had many other demands on both their time and energy at the time of the study. Future studies would benefit from implementing an intervention during a period of time in which participants can devote a significant amount of mental attention to their mental imagery practice (i.e., during winter break). Furthermore, due to the ongoing nature of the present study, it is probable that some of the participants became aware of the content and intentions of the study due to the fact that their teammates and/or friends may have previously participated. This confound may have caused some participants to lose interest during the course of their participation in the research study.

Above all, future studies of this nature would benefit from a control group. Due to time and participant number constraints, the present study was not able to incorporate a control group. Past research by Pates et al. (2000, 2001, & 2002) has utilized an ABA design, in which participants serve as their own control. This method and the design of the present study are not ideal, as they do not control for numerous variables between pre and post-testing. An ideal study of this nature would compare the efficacy of mental practice and physical practice at improving physical performance. In the case of the present study, for example, it would have been ideal to compare performance improvement between a physical practice only control group, a cognitive-specific imagery group, a cognitive-specific imagery + physical practice group, a flow imagery group, and a flow imagery + physical practice group. This model would have been effective at both comparing whether mental practice can improve performance and determining which type of mental practice or mental practice + physical practice group is most successful at improving basketball performance and flow experience.

Future Directions

Future studies of this scope and scale could benefit from additional researchers who serve to remind and encourage participants to practice their mental imagery interventions, or through the creation of individualized mental imagery interventions for each participant based upon their own athletic skill-set and experiences with flow. This could increase the participant's desire to practice, as the recording would be more personally relevant to them. For example, participants who have not developed or needed to develop a three-point shot as part of their basketball skill repertoire would have found either of the imagery interventions of the present study less relevant to them. Furthermore, these participants were at a performance disadvantage in the present study, as an emphasis was placed on three-point shooting performance in the shooting task. Past researchers such as Schreiber et al. (1991), Onestak (1997), Pates and Maynard (2000), Pates et al. (2001), Pates et al. (2002), and Nicholls et al. (2005) have utilized more personalized approaches when designing and implementing their mental practice interventions. While the sample sizes in these studies were incredibly small in comparison to the participant population of the present study, they allowed the researchers to tailor their experiment to the needs of their participants, which not only made the intervention more applicable to the field of sport psychology, but may have also increased participant motivation. Future studies might benefit from creating a *series* of progressive sports mental imagery interventions in which every mental imagery recording becomes progressively more difficult in regards to its sports imagery content. Such content could involve sounds associated with environmental distractions, or in the case of basketball, having the shot locations become progressively more difficult. For example, the first recording could have participants practice short bank-shots on the basketball court. The final recording could involve the mental practice of shots from all spots on the basketball court and in the presence of environmental distractions or sound effects. Such a mental imagery series might serve to increase participant motivation and to decrease monotony. This may have been a problem in the present study as participants were asked to listen to the *same* mental imagery intervention once daily for six days. A new, more difficult, mental imagery recording for each day would likely prevent participants from experiencing burnout or boredom with studies of this nature.

Future studies could also have participants set performance goals for post-testing as a means of increasing flow experience. A key characteristic of flow is “clear goals and feedback” (Csikszentmihalyi, 1990), and I think that it would have been interesting to see what the results of this study would have been if participants in the flow group had been required to set performance goals for post-intervention testing on the basketball shooting task, or if the flow imagery intervention had incorporated motivational specific imagery (Paivio, 1985). Participants in the flow imagery group of the present study had to re-experience feelings associated with past flow experiences (Motivational-General-Arousal imagery), image themselves experiencing success in a challenging environment (Motivational-General-Arousal imagery), and listen to audio that was laden with the nine characteristics of flow (Csikszentmihalyi, 1990). Future studies may wish to take a flow intervention one step further through the inclusion of motivational-specific imagery or by having participants set performance related goals.

Conclusions

Past research has suggested that it is incredibly important to experience flow within our daily lives if we wish to be happy. Contrary to popular belief, environments that do *not* provide challenges *nor* require individuals to apply themselves to a task tend to be *less* satisfying than environments that provide challenges and require people to apply themselves. Large-scale positive psychological findings such as these have important consequences within the realm of sports psychology, especially because the nature of sports provides an environment that is conducive to the experience of flow.

An understanding of flow can help athletes take steps towards increasing their athletic performance abilities and help coaches make informed choices with regards to how they create learning environments that are encouraging for flow experience in their players. Because most athletes rely upon coaches for advice on how to approach skill development, the psychology of flow may be especially relevant to helping them develop and implement successful coaching strategies. For example, coaches would be well-advised to have their players set goals as a means of maintaining focus on their athletic development over the course of a season. Additionally, instructors who detail the small goals that they want their sports team to achieve in specific competitive situations may help their players preserve focus when these situations arise (i.e., detailing the specific goals in how to break full-court pressure in basketball). Coaches who apply the principles of flow to their coaching philosophy can increase athlete development through the use of goal setting, help athletes perceive the challenges of their athletic environment as positive, and ultimately increase the enjoyment their players derive from participation in sports.

Despite the lack of significant findings generated by the present study, this study offers intriguing support for sports psychology and flow research. Prior to the present study, there had been no known research studies that had tried to increase flow experience and athletic performance within such a large participant population. Furthermore, the present study was the first of its kind to implement and create a “flow” mental imagery intervention without the use of hypnosis and the first of its sort to create a basketball-shooting task specifically designed to be conducive to flow through the provision of the challenge/skills balance component of flow. In this light, the present study pioneered many new ideas and can serve as a resource for future researchers who are interested in investigating the experience of flow among athletes, and more specifically, flow among basketball players.

The experience of flow is one of the most enjoyable experiences in life, and sports is one of the only leisure time activities that innately provides people with an environmental context that is conducive to flow. However, if athletes are unable to fully immerse themselves in their activities, it is likely that they will not experience sports as positively as they could. It is therefore the job of sports psychologists and researchers to strive to understand how to help people derive more flow from their environments.

Appendix A: Cognitive-specific Mental Imagery

Imagine yourself holding a basketball as you stand on the right block. Feel and see the ball in your hands. Above you notice the glass backboard and the white box that forms the white bank shot box. See yourself release the ball and watch it as it goes off the backboard and into the hoop. Take yourself through this process five times now. Here's 1….. 2….. 3…. Off the backboard and through the hoop…. 4….. and 5….

Now, switch sides and visualize yourself making five shots from the left block. Here is 1… see the ball banking off the backboard and through the hoop… 2…. 3 this is an easy shot…. 4…. And 5.

Now, position yourself at the right elbow or T. Visualize this new distance. Feel yourself bending at the knees and pushing yourself upward as you release your shot and watch it go through the net. 1…. Watch the ball spin through the air and go through the hoop…. 2…. 3….4….and 5…….

Now, move over to the left elbow. Visualize what a shot from this angle looks like, and then take yourself through your shooting motion. Again, bending at your knees, extending, and releasing the ball as you watch as it swishes through the hoop. Here's your second shot. Hold your follow through and watch the ball go through the hoop. Watch as the ball swishes through the net. 3…. 4…. And 5…. You've made five shots from the left elbow.

Now, picture yourself at the right baseline corner- just beyond the three-point line. Take five three-point shots from here. Notice the ball as it leaves your hand and as it spins through the air before swishing through the hoop. Really focus on your shot from here. Notice how a successful shot depends upon your entire body working together in unison, starting with your legs. Hold your follow through as you release your shot. Watch and hear the ball swish through the hoop. Here's your first shot: 1…. 2…. Hold your follow through…3…..4…..and 5…. You've made five three pointers from the right baseline.

Now, picture yourself at the right elbow line extended, just beyond the three-point arc. Take your first shot… Watch the ball release from your hands and swish through the hoop. With your second shot go through your shooting motion, and be sure to hold your follow after you release the ball. Watch the ball go in through the hoop. Feel the ball leave your hand as you take your third shot. Watch as it spins toward the hoop and goes in with a swish. As you take your fourth shot, experience your entire shooting motion: bending at your knees and pushing your body upwards, you raise the ball and release it with your shooting hand, while your guide hand trails off to the side… the ball goes swishing through the hoop. See yourself making your final shot now.

Next, picture yourself at the left baseline corner just beyond the three-point arc. Square up to the basket. You have the ball in your shooting hand. Making a three-point shot from the baseline requires a great deal of accuracy. Imagine yourself making five shots from here now. Here's 1…. 2…. See the ball spin through the air as it leaves your hand

and swishes through the hoop….3…. 4…. See the ball go in…. and 5…. You've made your fifth shot.

The next spot is just beyond the three point arc, at the left free-throw line extended. Picture yourself at this spot on the court, facing the basket. At this point you know what to do and are almost done with your mental imagery practice for today. Examine the distance between where you are and where the basket is. Square up. See the ball release from your shooting hand and spin through the air, swishing through the hoop. Here's 1…. See yourself make your first shot… now your 2nd….2….. now your 3rd…. 3…… your 4th….4….. and finally your 5th…..

Now, move up to the top of the key just beyond the three-point line. The basket is centered in your vision. Watch the ball soar from your shooting hand and splash through the hoop five times from here. See your first shot go in now…. 1…. And your 2nd…. 2…. Your 3rd….3….. your 4th….. and finally your 5th shot… watch as the ball spins through the air and swishes through the hoop.

Thank you.

Appendix B: Flow Mental Imagery

Imagine yourself now on the basketball court. Today you are going to play basketball and decide to warm yourself up by taking shots from a series of spots on the court. However, prior to taking these shots you must get your mind ready for playing too. The last time you played basketball you realized that how you perceive the challenges in your environment plays an important role in how you feel about your basketball abilities. In other words, when you perceive your abilities as unable to meet a challenge you will likely feel anxiety while playing basketball. However, when you perceive your abilities as sufficient to meeting the challenges of your environment, you will be mentally ready to take on whatever comes your way. Having a positive mindset like this will help you perform at the top of your game.

Think about a time when you played your best basketball. Maybe there was a particular play or series of plays this season that you are especially proud about. Recall these memories now, and allow yourself to re-experience the feelings of pride, energy or enjoyment that might be attached to them. Take some time to do this now………………

Recalling past times of success on the basketball court can be a helpful tool in preparing you to play basketball again. The memory can help you get psyched up and improve your outlook on the game.

You are now going to continue your warm up by incorporating the feelings of your past basketball success and expectations for continued success into your shooting practice.

Imagine yourself on the basketball court. You are aware that there are other people and players around you. Noises typical of a crowded basketball gym fill the air. None of this matters to you, however, as you are going to devote your attention towards your shooting practice all the while psyching yourself up with your memories of past basketball success.

You start your warm up at the right block. See yourself make five consecutive bank shots from here. You feel confident and in control. Here's 1….2….3…..4…..and 5…..

Now on to the left block. See yourself make five bank shots from here. You are continually reinforced about your basketball abilities as you make these five bank shots in a row. Here's 1….2….3….4….and 5….

You are now at the left elbow. Recall again your past basketball successes and try to incorporate that mindset and those memories into this shooting workout. You feel great as you shoot the ball. See yourself make five shots from the left elbow now. Here's 1….2….3….4….and 5…..

Switch sides to the right elbow. Stay focused. You are in a crowded gym but the only thing that is important to you is staying focused and warming yourself up. See yourself make five jump shots from the right elbow now. 1…. Your shots feel incredibly natural….2…. see that ball go in…. 3….4…. and 5…. You made all of your shots.

Now, see yourself behind the three-point line at the right baseline. This is a challenging shot, but you know that you have the abilities to make it. See yourself make five baseline threes from the right side now. Here's 1…. You are so focused on your warm-up shooting that you block out everything else around you…. 2…. 3…. 4…. And 5….

Staying behind the three-point line, move up to the free-throw line extended on the right side. Keeping your shooting streak alive, you are going to make five consecutive three-pointers from this spot. You are getting warm now, and are riding a wave of success as you continue with your shooting workout. You can make these shots. Here's 1…. 2…. 3…. 4…. And 5….

Now, you are behind the three-point line at the left baseline. You haven't missed a shot and you are completely in the zone. All that matters to you is staying focused and doing your best. Here's your first three-pointer from this spot…1…. 2…. 3…. 4…. And 5…. This feels very natural.

Staying behind the three-point line, move up to the free-throw line extended on the left side. Though you don't dare to stop and acknowledge it, you are in the zone, and are almost done with your warm-up. Whether or not the crowd has been watching your shooting streak or not you don't care. All you care about is focusing on your shooting warm-up. Here's your first shot… 1…. And your second… 2…. 3…. 4…. And 5….. Unstoppable.

Your final spot is the top of the key behind the three-point line. Seemingly automatically, you begin to unload your shots one after another, nothing but net each time. Here's 1…. 2…. 3…. 4…. And 5….

You are now warmed up and ready to play at the top of your game.

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